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IMPACT OF ECHINOCOCCOSIS ON BEEF QUALITY IN UZBEKISTAN

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ABSTRACT

Assortment of finished products of meat is quite large in the food market of Uzbekistan, but these products quality are varying. Today quality control of meat and meat products is very important in slaughterhouses in terms of safety. The conducted studies of the meat of healthy and echinococcosis animals allow us to conclude that this disease has some influence on some parameters that determine the quality of meat. According to a study of 1679 cattle slaughtered in slaughterhouses in the Samarkand region of Uzbekistan, the average incidence of echinococcosis was 8.6%. In terms of organoleptic parameters, the meat of healthy animals does not differ from the meat of animals suffering from echinococcosis. Echinococcosis leads to a decrease in the nutritional value of meat, which is expressed by low levels of protein and fat. This indicates that during invasion by echinococci in the studied tissues and organs, the pH indicator shifts towards an alkaline reaction due to the primary decay of the protein. The high moisture content in the

meat of animals with echinococcosis is an unfavorable factor affecting the resistance of meat to long-term storage.

KEYWORDS: *Echinococcosis, safety, quality, cattle, beef, muscle, slaughterhouse.*

INTRODUCTION

Providing the population with food and healthy nutrition is an important and urgent task of national importance. Social stability of society and health of the population is impossible without its solution. In recent years, in connection with the change in the nature of the domestic market, measures have been taken to integrate the Uzbek economy into the world one. When solving this important state task, the requirements of environmental and sanitary control imposed on Uzbekistan by the member countries of the World Trade Organization are taken into account.

The concept of healthy nutrition of the population and the state policy for creating the foundations of biological safety in our country involve the modification of the legislative framework and regulatory and methodological support of state supervision over the quality of animal products, the harmonization of which with international standards is an urgent area of veterinary sanitary examination and food safety of Uzbekistan [1,2,22].

In this connection, it is necessary to constantly improve and test modern scientific achievements and carry out systematic control aimed at preventing substandard products from entering the sale, in case of animal helminthiasis, in order to eliminate harmful effects on human health [11,13].

Echinococcosis - are chronic helminthiasis characterized by destructive lesions of the liver, lungs and other organs, allergization of the body and severe complications, often leading to disability and death. [6,17,18]. It is a new disease in many parts of the world, especially in the countries of the former Soviet Union, Eastern Europe and Asia [21,23].

There are difficulties in early diagnosis, surgical interventions are carried out in advanced stages, there are certain difficulties in carrying out comprehensive preventive measures that are associated with serious economic problems [4].

WHO and the International Bureau of Epizootic have included echinococcosis in the list of diseases subject to radical eradication [3,14]. In a number of countries (New Zealand, Argentina, Greece, Turkey, Spain, Italy, etc.), for which echinococcosis is a marginal pathology, its elimination has been raised to the rank of a state task, special national programs are being developed to control and prevent the disease. Thanks to such programs, in a number of countries previously unfavorable for echinococcosis (Iceland, Norway, Australia, and Tasmania), the disease has practically been eradicated [24]. Echinococcosis not only harms the health of animals and humans, but also causes economic damage, and therefore continues to be an important public problem [5,7,8,9,10,].

Thus, given that animal husbandry is a traditional branch of agriculture, and meat products constitute a significant proportion of the population's diet, research and development of scientifically grounded criteria for assessing the quality and safety of cattle slaughter products in case of echinococcosis in Uzbekistan remains a problem, the relevance of which is beyond doubt, which determined the purpose of these studies.

The aim of the study was to determine the quality and safety of meat and meat products from cattle infected with echinococcosis.

MATERIALS AND METHODS

Study area and animals

The study was conducted from February 2020 to January 2021 in the slaughterhouses 21 in Samarkand region, Uzbekistan. A total of 1679 slaughtered cattle in age of 2 to 5 years were observed.

Post mortem examination

Post-slaughter veterinary and sanitary inspection of carcasses and organs of slaughtered livestock are carried out in accordance with the requirements of the Cabinet of Ministers on the "On measures to further improve the system for streamlining the activities of specialized enterprises for slaughtering livestock and delivering meat and meat products to the consumer market" by the chapters 4-5 of decision № 386 accepted on May 8 in 2019.

Meat chemical analysis

For the chemical analysis of meat of cattle in the conditions of slaughterhouses in the city of Samarkand, samples were taken from 5 infected and 5 non-infected with echinococcus carcasses of animals of each species. A sample weighing approximately 200 g was taken from each carcass from *Musculus longissimus dorsi*. The samples were enclosed in a sealed container, labeled and stored at - 5° C until analysis.

The chemical composition of beef was determined by a set of methods: moisture - by drying at 105°C, fat according to Soxhlet, total protein - by the modified Kjeldahl method, minerals - by burning in a muffle furnace.

Healthy and echinococcosis-infected cattle were carried out in accordance with the rules of veterinary-sanitary examination in determining the physicochemical parameters of meat and meat products (reaction with 5% copper sulfate solution, peroxidase reaction, formalin reaction and pH) [20].

The organoleptic characteristics of meat and internal organs were studied in accordance with GOST (7269-79) and legislative standards (appearance and color, texture, smell of meat condition of fat and tendons).

The cleanliness, chemical and microscopic analysis of meat was carried out in accordance with the standard «GOST 23392-78» [16].

Data analysis

Basic data entry and handling were done using MS Excel (2010). The significance of differences among chemical values of each sample was determined by analysis of variance (ANOVA) and t-test. Prevalence of echinococcosis was calculated as the number of cattle found infected with echinococcus expressed as the percentage of the total number of slaughtered. Differences were considered significant at $p < 0.05$ level.

RESULTS

Post mortem examination

In the process of post-mortem veterinary and sanitary examination, echinococcal blisters of various sizes were found in the liver and lungs, the affected organs had a hard consistency and a bumpy surface. The condition of patients with echinococcosis and healthy animals was average.

At postmortem examination, a visual inspection was made of the condition of the carcass, the head and regional lymph nodes. In carcasses of healthy animals the muscles were well developed, thoracic and lumbar vertebrae, hips were allocated not sharply; the neck, scapula's, forward ribs and legs, the pelvic cavity and area of a groin had fat deposits in the form of small sites. In terms of organoleptic indicators, the meat of sick animals did not differ from that of healthy animals: the carcasses of the animals had a dark red color, with a specific smell, dense consistency; the cut surface was moderately moist.

In carcasses of animals, infected by echinococcosis, there were less developed muscles, prominent spinous processes of vertebrae; a poor development of the fatty layer was noted.

During the study, from 1679 cattle obtained from the slaughterhouse, 145 (8.6%) animals were positive for echinococcosis. Contamination by echinococcosis of cattle had rather stable character and slightly varied depending on a season of slaughter of cattle (Table 1).

TABLE 1. DYNAMICS OF ECHINOCOCCOSIS INFECTION OF CATTLE ON SEASONS OF YEAR (2020)

Seasons	Number of cattle		Prevalance %
	Investigated	Infected	
Winter	485	47	9.6
Spring	326	36	11
Summer	418	28	6.6
Autumn	450	34	7.5
Total	1679	145	8.6

In the winter the contamination of cattle was, on the average, 9.6%. The infection prevalence was rather high during the spring period and reached 11 %. In the summer and autumn the prevalence was lower, 6.6% and 7.5%. The average level of contamination of cattle was 8.6%.

Infection of the internal organs of cattle with echinococcosis indicates that in most cattle only 67.6% had liver damage. Simultaneous damage to the liver and lungs was 31.0%. The kidneys, liver and lungs of cattle were simultaneously damaged by 1.4% (Table 2).

TABLE 2. DISTRIBUTION OF ECHINOCOCCOSIS CYSTS ON ORGANS OF THE INFECTED CATTLE (N = 145)

Organs	Distribution of echinococcosis	
	Number of animals	%
Liver	98	67.6
Liver, lungs	45	31.0
Kidneys, liver, lungs	2	1.4

Physicochemical examinations

After the animals are slaughtered, the meat obtained undergoes complex biochemical processes, i.e. the meat is cooked, the hardness changes, the moisture and the smell change. Therefore, it is important to compare the physicochemical parameters of the results of laboratory tests in the veterinary and sanitary examination and assessment of the quality of meat from sick and healthy animals.

The examined beef samples were reddish in color when viewed in natural light, weakly moistened on a well-blooded cut surface, and no traces of moisture remained on the surface of the filter paper. The consistency of the meat is firm, the puddle formed when the surface of the meat is pressed with a finger quickly returned to its original position.

Physicochemical parameters of beef infected with echinococcosis and clinically healthy cattle are presented in the results of standard studies (Table 3).

It was revealed that in the reaction with a 5% solution of copper sulfate, the meat filtrate remains transparent, without foreign substances in both groups of cattle infested and not infested with echinococcus cysts.

The reaction of peroxide extract of beef infected with echinococcosis formed a dark brown color, the reaction was negative, a blue-green color was formed in the extract of healthy animal meat, and after a few minutes it changed to dark brown color, the reaction was positive.

TABLE 3. CHANGE IN PHYSICOCHEMICAL PARAMETERS OF CATTLE MEAT IN ECHINOCOCCOSIS

Animal groups	Physicochemical indicators of meat (n=5)			
	reaction with 5% copper sulfate solution	peroxidase reaction	formalin test	pH
Healthy	clear, nothing foreign	+	The soup is clear, the reaction is negative	$5,8 \pm 0,2$
Infected with echinococcosis	partially fuzzy	-	The soup is partially cloudy, the reaction is positive	$6,2 \pm 0,1$

In the examination of beef infected with echinococcosis, the broth was partially turbid and the reaction was positive in the formalin reaction, while in healthy beef the broth was clear and the reaction was negative.

The concentration of hydrogen ions (pH of meat) in the meat of animals in the control group 1 hour after slaughter was 6,2-6,3, experimental – 6,3-6,4. One day after slaughter, the pH of the meat of healthy animals was 5,8-5,9. In the first hours of autolysis, glycolytic processes predominate, leading to the accumulation of lactic acid, as a result of which the pH value of the muscle tissue decreases.

Immediately after the slaughter of the animal, before the onset of pronounced post-mortem changes, the meat has an elastic consistency, pink-red color and has a high moisture-binding

capacity, but its aroma is weak. Termination of animal life is a triggering mechanism in the development of post-mortem changes, the nature and depth of which determines the qualitative characteristics of muscle tissue, its physicochemical properties and directly affects the functional and technological parameters of raw meat. Due to the breakdown of glycogen and the accumulation of lactic - phosphoric acids (as a result of dephosphorylating of intermediate products of glycolysis: glucose phosphates, and subsequently, creating phosphate and nucleotides), the reaction of the muscle tissue environment shifts to the acidic side. Such a shift in the indicator to the acidic side indicates a high activity of glycolytic enzymes, which contributes to the normal course of the maturation of meat and its long-term storage. In sick animals, the concentration of hydrogen ions after 1 day was on average $6,2 \pm 0,1$ which indicates violations of glycolysis processes, which ultimately affects the digestibility and assimilability of such meat (see Table 3).

Biochemical properties of muscle tissue in cattle

As a result of the study, it was found that in cattle infected with echinococcosis, the moisture content in the muscle tissue is higher than in healthy animals and is $70,14 \pm 0,007$ and $65,1 \pm 0,2$ g/100g, respectively. This demonstrates an increase in muscle hydration. Protein concentration in healthy animals was 7 % higher than in infected animals (table 4, figure 1).

TABLE 4. NUTRITIONAL VALUE OF BEEF

Indicators	Meat of animals	
	Healthy (n=5)	Infected with echinococcosis (n=5)
Nutrition value (g/100 g)		
Proteins	$21,34 \pm 0,4^*$	$18,9 \pm 0,7$
Fats	$15,3 \pm 0,03^*$	$9,36 \pm 0,06$
Moisture content	$65,1 \pm 0,2$	$70,14 \pm 0,007^*$
Ashes	$0,86 \pm 0,02$	$1,12 \pm 0,005^*$
Calorific value cal/100 g	$190 \pm 0,83^*$	$162,6 \pm 0,4$

* $p < 0.05$ value differ significantly.

The content of fat in muscles in sick cattle was significantly lower, and amounted to 38 % of the value in healthy livestock. The energy value of beef also depended on the presence of infestation in animals and was lower in sick cattle by approximately 28 calories per 100 g of sample.

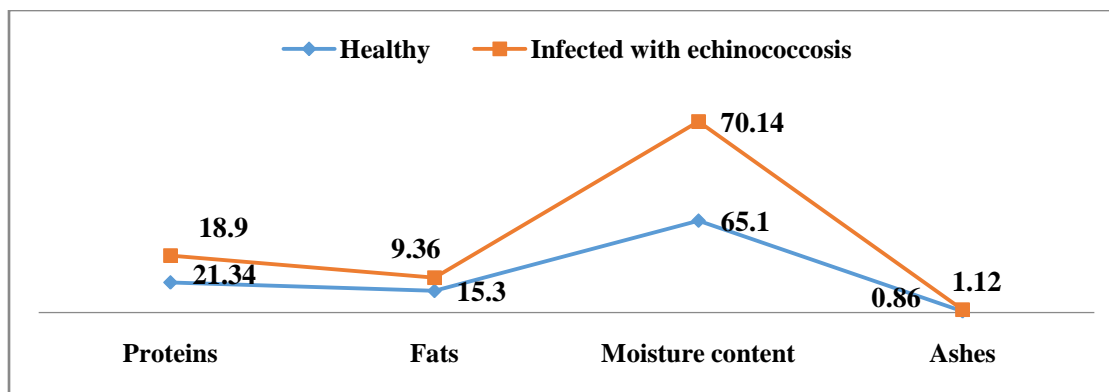


Figure 1. Nutritional value of beef (g/100g)

DISCUSSION

Our research demonstrated that the average contamination of echinococcosis of slaughtered cattle aged 2 to 5 sold through the market in the Samarkand region of Uzbekistan is 8.6%. The incidence of echinococcosis infection in adult cattle did not display large fluctuations on seasons of the year. In our opinion, this is explained by the constant character of the invasion by oncospheres during the life time of the cattle. Accordingly, the lowest prevalence of infection of cattle established during summer and autumn seasons of year. Parasites are mainly found in liver and lungs (in 98.6% of animals). In other isolated cases there were observed multiple echinococcosis with simultaneous infection of kidneys or spleens.

Studies of the chemical composition of meat and meat products of sheep infected with echinococcosis established that the maintenance of protein and fat decreases, and moisture increases (Z.Valieva et al.,) [26].

The results of the current study have shown that nutrient composition, fatty acid profile, levels of amino acids, vitamins and mineral elements in meat from healthy animals differ in results obtained from various regions of the world (Levies et al., 1995; Brzostowski et al., 2004) [19,12]. Williams (2007) indicated that nutritional composition of beef depends on breed of cattle, feed, season and cut of meat [25].

The biochemical analysis also showed that in the beef from cattle infected by hydatidosis, in comparison with muscle tissue of healthy animals, the amount of protein and fat, calorific value significantly decrease. Besides, in the meat of animals infected with echinococcosis there is a substantial increase of humidity and amount of ashes.

The results of the conducted studies allow us to conclude that biochemical changes in the meat of invaded animals are the reason for a decrease in its biological and nutritional value.

CONCLUSION

Studies on the meat of healthy and echinococcosis-infected cattle have led to the conclusion that it affects some parameters that determine meat quality. According to organoleptic tests, the meat of healthy animals is no different from the meat of animals infected with echinococcosis.

The physicochemical changes shown in the muscle tissue of infected cattle led to a decrease in the biological value of the meat. The energy value of beef also depended on the presence of infestation in animals and was lower in sick cattle by calories per 100 g of sample.

With echinococcosis in meat of cattle, in comparison with healthy animals, the moisture content significantly increases by 7%; the amount of protein is reduced by 7%, fat - by 38%, energy value - by 28%;

PRACTICAL SUGGESTIONS

Based on the results obtained, it was revealed that echinococcosis causes a complex of physicochemical, biochemical changes and is the reason for a decrease in the biological and nutritional value of the slaughter products of invaded cattle.

Carcasses of cattle infected with echinococcosis regardless of the degree of invasion, it is recommended to send for industrial processing with heat treatment for the manufacture of boiled and boiled-smoked sausages, and internal organs for technical disposal.

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